OceanIQ

CASE STUDY

PROXIMITY STUDY CASE STUDIES

Overview

OceanIQ worked with British Telecommunications (BT) to undertake a study into the implications of conducting a submarine telecommunication cable repair inside the planned Borssele Offshore Windfarm. This resulted in the development of a new repair methodology, the Cable Repair And Lay Through (CRALT).

The main objectives of this report were to:

> Identify the operational risks and limitations of a CRALT repair.

> Determine the likely cable recovery, repair and lay through methodology for the Borssele OWF.

> Identify risk mitigation options and any associated costs.

> Determine the durations, outage times and costs of a CRALT repair, for each cable affected and for each windfarm zone inside Borssele.

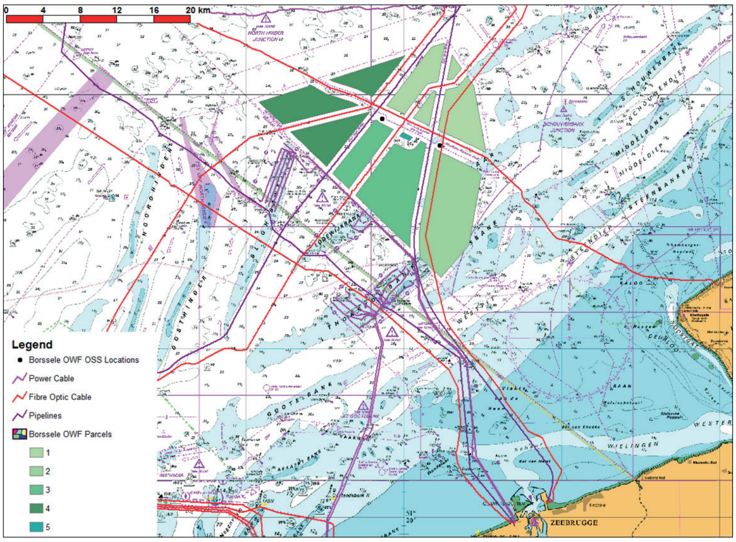

Figure 1: Borssele OWF Overview

Borssele OWF Zone

The Borssele OWF Zone is comprised of five sites. Borssele I & II developed by Ørsted, Borssele III & IV by Blauwwind, a consortium of Shell, Van Oord, Eneco and Mitsubishi/DGE, while the Borssele V site was earmarked as an innovation site and developed jointly by Van Oord, Investri Offshore and Green Giraffe .

Borssele I & II has a capacity to produce 752MW, Borssele III & IV production capacity is 731.5MW and Borssele V capacity is 19MW. The export cables transmitting the power from the Borssele sites to the Dutch mainland are owned and operated by TenneT.

The Borssele windfarm development represents a huge investment in renewable energy, involving the construction of 713 Wind Turbine Generators (WTGs), 2 offshore substations (OSSs) and a large quantity of power cables to link the WTGs and OSSs to each other and the shore.

Within the Borssele OWF there are also two large existing gas pipelines and an additional fibre optic (FO) submarine telecommunication cable called Concerto East, which is not active.

BT has sole or partial ownership of three in-service fibre optic submarine telecommunication cables installed between 1996 and 2000, which lay inside the Borssele OWF development. These carry telecommunications traffic for BT and are classed as critical infrastructure supporting the global internet and communications networks.

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Considerations

Repair operations

The study determined the practical and commercial impact that the Borssele OWF would have on repair operations to the existing BT FO submarine telecommunication cables.

These types of cables periodically suffer faults of either an optical or electrical nature. In general, most faults are due to external aggression and the most common causes are related to bottom contacting fishing gear (especially trawling) and anchors. Our study looked at historical and current fault rates for the BT cables within the Borssele OWF zone to predict the frequency over a 25-to-40-year operational lifespan of the wind farm.

After construction of the Borssele OWF access would be restricted by the windfarm infrastructure and subsea cable repair work would become more complicated due to the presence of numerous new power cable crossings. This inevitably has an impact on how future repairs are undertaken to the existing cables.

The study referred to two different methods of cable repair:

> A spot repair refers to a standard cable repair that is undertaken in the open sea where the new repaired section of cable inserted is only limited to the extent of damaged cable and water depth. This is the pre-existing baseline situation.

> A CRALT repair refers to how a repair where the repair joints are performed outside the OWF array and the repair section is laid through the OWF. Using this method, the repair section of cable inserted is determined by the extents of the array and the water depth. This is a novel methodology designed specifically for OWF's.

The ways in which a cable repair will change due to the Borssele OWF presence were explained. . To better understand the new marine environment the Borssele OWF created, the post-construction cable crossings were identified. This information fed directly into the calculations which determined the forecast repair durations and costs at the end of the report.

A main recommendation was the preparation and mutual approval of operational processes and procedures for a CRALT or spot repair. By developing these with the relative asset owners (telecom cable, power cable, pipeline, windfarm owners and the relevant authorities) to satisfy their relative QHSE (Quality, Health & Safety and Environment) responsibilities, they greatly enhance the efficiency of any future CRALT or spot repairs.

The main summary impacts of the proposed Borssele OWF were:

> A spot repair within the windfarm needs to have in consideration the contracted FO telecommunications cable repair vessel specifications due to lack of sea room and the impact this has on safety.

> A CRALT with a DP1 cable repair ship repair is possible but is significantly more expensive in average annual weather.

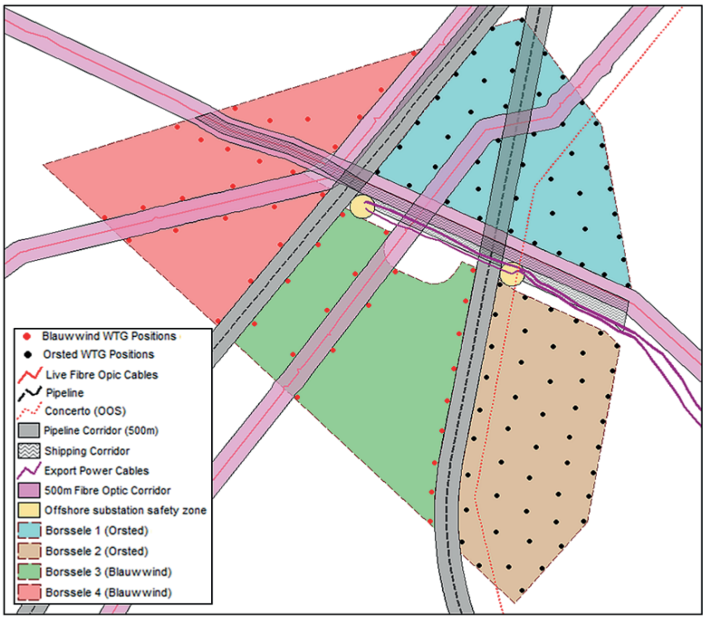

Figure 2: Borssele OWF Cable Corridors and Infrastructure

> Proximity and crossing agreements should be agreed in advance to address the practical and financial impacts between all parties involved.

> Clarity was required from the developers and Dutch authorities over the types and nature of marine activity which will be allowed inside the OWF during and after construction, and the notification period and process steps for telecommunication cable ship repairs.

Risk Mitigation

This study also investigated the sources of risk to the repair operations, ways to mitigate these risks, and how the risks may change. It also investigated ways to mitigate cost to both parties.

The mitigation measures can be summarised as:

> Marine liaison and monitoring

> Optimising OWF infrastructure design

> Restrictions on marine activities within the OWF

> Periodic marine survey

> Enhanced processes

> Plant pooling

> Framework agreements

Regulations and Guidelines

Several sets of regulations and guidelines were consulted, and relevant sections were present in the report. Current internationally recognised proximity guidance relevant to the cable industry and the existing regional guidelines within the Dutch and Belgian sector, were also referenced within the report.

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Second Study

A second study separate to the original Borssele OWF Study was commissioned by the cable owners to investigate and quantify the impacts of 8 Belgian and 3 Dutch OWF's which lie directly adjacent to Borssele and over the telecommunication cables. The other OWF's are in various stages of development. Because these other OWF's lie directly next to the Borssele OWF, the end result was an extension of the CRALT repair lengths required and therefore the repair durations.

The studies were intended to be read together to gain the fullest understanding of all the impacts across the various projected Dutch and Belgium developments that are planned.

The requirements of the different coastal states (the Netherlands and Belgium) vary. Within the Belgium zone, the Belgian OWF's incorporate cable maintenance corridors intended to allow access to the in-service cables, which are 250m either side of the existing cable, 500m wide in total. In the Dutch zone, the Borssele and HKZ OWF designs also incorporate cable maintenance corridors to allow access to the in-service cables which extend 500m either side of the cable, 1km wide in total.

Understanding that these maintenance corridors exist and were of concern, the cable owners independently sought the view of the contracted FO telecommunications cable repair operators.

Study Conclusions

The conclusions drawn followed a detailed investigation, including reference to various sets of regulations and guidelines which were referenced within the body of the reports. The ways in which a cable repair will be altered because of the windfarm presence were explained based on the capabilities of the contracted ACMA vessels.

The methodologies discussed were referenced against SPOT Repairs and/or Cable Repair and Lay Through (CRALT) techniques. To better understand the new environments created by any new OWF developments, the post-construction cable crossings were also included. This information fed directly into the repair duration calculations, which determined the time and cost of repairs at different times of the year.

A reasonable and balanced approach to offshore proximity discussions was recommended as many of the factors discussed theoretically within the study become superfluous at sea when the overriding safety concerns of any cable ship captain prevail.

The master of any vessel at sea is fully accountable for the safety of his/her vessel and crew working in the environmental and weather conditions of the day. These conditions are outside of either the licensing authority, cable owners or renewable developer's control.

Both ESCA and ICPC state that "The master or captain will always retain the prerogative to depart from guidelines (or recommendations)" as it is the captain who is responsible for the safe navigation of the vessel and for the safety of those on board.

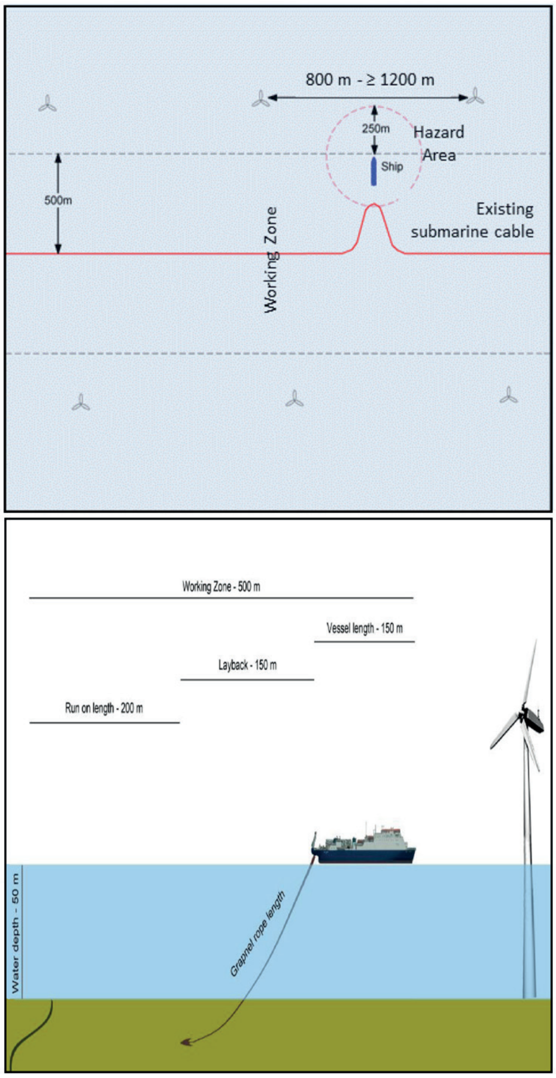

Figure 3: Illustration of the working zone and hazard area that defines the separation distance (ESCA, 2016)

Conclusion

As offshore electricity transmission projects grow, the significance of strategic space management and route optimization cannot be overstated. It's imperative not only for accommodating various ocean activities and resources but also for upholding infrastructure integrity and ensuring telecom and electrical supply reliability.

Leveraging OIQ's pivotal position within the Global Marine Group, we've amassed substantial expertise in installing and maintaining both subsea telecommunications and power cables over many decades. This rich experience has granted us a profound understanding of the skills, technology, equipment, and assets required for planning, installing, burying, storing, testing, locating, recovering, and maintaining subsea cables.

At OceanIQ, our commitment extends to safeguarding cable assets and enhancing access to construction and maintenance sites, along with optimizing export and inter-array cable routes. Our objective throughout is to mitigate any potential negative impacts on cable routing efficiency and wind farm design.

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